From one to many islands : the emergence of search and matching models

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Discussion Paper 2009-05

Institut de Recherches Économiques et Sociales
de l'Université catholique de Louvain

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From one to many islands: the emergence of search and matching models*

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February 2009

Abstract

The notion of frictional unemployment first arose in the writings of Beveridge, Pigou and Hicks. Why did it fail at the time to grow into a fully fledged theory? Our answer is simple. This failure was due to the fact these economists were unwilling and/or unable to go beyond the then-prevailing Marshallian approach, in particular to depart from its trade organization assumptions. They did not realize that these assumptions excluded any rationing outcome in general, and any unemployment result in particular. We make our claim in three steps. First, we make explicit the trade-organization assumptions underpinning Marshall's equilibrium theory. Our second step is a study of the attempts at introducing unemployment in a Marshallian framework. We start with an examination of Beveridge's, Pigou's and Hicks's early works on wages and unemployment. We also briefly discuss how and why Keynes was able to shift attention from frictional to involuntary unemployment. Next, for a reason that will become clear as the paper evolves, we ponder Friedman's celebrated Presidential Address inaugurating the notion of a natural rate of unemployment. In our third and last step we look at the papers by McCall, Lucas and Prescott, Mortensen and Pissarides that paved the way for the present thriving research literature. We show that their success in providing an equilibrium unemployment result stems from the fact that they have indeed departed from the Marshallian trade-organization assumptions.

Keywords: Supply and Demand, Marshall, Search, Matching

JEL-Code: B10, B20, B40, J20, J60

*Special thanks to Bruno Van der Linden and Martin Kessler.
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1 Introduction

The island metaphor, which forms the title of this article, was proposed by Phelps in the introduction to his celebrated volume of essays, *Microeconomic Foundations of Employment and Inflation Theory* (Phelps (1970)). Phelps's intuition was that the standard account of the functioning of the labor market was unable to deliver a satisfactory theory of unemployment. Some departure from it was needed. His hunch was that theorizing should proceed along two lines by introducing both decentralization and imperfect information:

> I have found it instructive to picture the economy as a group of islands between which information flows are costly: to learn the wage paid on an adjacent island, the worker must spend the day traveling to that island to sample its wage instead of spending the day at work (p.6).

If Nobel Prizes were awarded to new ideas instead of new theories, Phelps's insight might have been a sufficient reason for giving him the prize because it triggered a new theoretical line of research, search and matching models, which have become the established paradigm for the study of unemployment. The aim of the present paper is to cast these models in a broader perspective by exploring their prehistory. The topic of unemployment in economic theory dates back to the first decades of the XXth century, when it gradually supplanted the topic of poverty. The first economists to be interested in the issue of unemployment, such as Beveridge and Pigou, took the view that its cause should be looked for in the existence of frictions or maladjustments. Although the meaning of frictions remained elusive, this insight was an anticipation of modern theory. Hence the question: what hindered the search approach's taking off at the time? This is the puzzle, which we aim to solve in this paper.

The main answer we will provide is that, at the time, most economists adhered to Marshallian value theory. We shall show that this framework (as it stood at the time) and unemployment, of any type, are incompatible bed fellows. It has room for disequilibrium but not for rationing. The reason for this, we shall explain, is the trade organization or conceptualization of the functioning of the market. If the Marshallian framework excludes unemployment, the *sine qua non* condition for constructing a theory of unemployment is to abandon Marshallian trade technology — the very move that modern search models have made. Interwar-period economists interested in the study of unemployment were unaware of this necessity. As a result, they were unable to theorize their insight that unemployment was a matter of frictions or maladjustment.

We start with a discussion of Marshall's view of the functioning of markets, bringing out the fact that it excludes the occurrence of rationing. Drawing from this analysis, we make clear what we understand by a Marshallian trade organization. Next we engage in a selective survey of the literature on unemployment after Marshall and before the rise of the modern search approach. We start with an examination of Beveridge's, Pigou's and Hicks's early works on wages and unemployment. We also briefly discuss how and why Keynes was able to shift attention away from frictional unemployment. For a reason that will become clear in due course, we also ponder Friedman's celebrated Presidential Address inaugurating the notion of a natural rate of unemployment. In the final part, we study the main

papers that introduced the search paradigm (by McCall, Lucas and Prescott, Mortensen, and Pissarides) and show how they all departed from the Marshallian supply-and-demand framework. On the basis of this departure, they started to explore alternative possibilities with respect to market fragmentation, informational assumptions, forms of searching and matching, employment relationships and pricing behavior. Unemployment could then become a compelling outcome.

2 Marshall (1920) on the functioning of markets

Our object of study in this section is Marshall's analysis of the outcome of market-day equilibrium (market equilibrium for short). This analysis was hardly Marshall's overriding concern when he constructed his theory of equilibrium. His interest lay rather in the study of normal equilibrium, a state of rest and the center of gravitation for market outcomes.[1] Nonetheless he broached the matter in Chapter II of Book V of the *Principles*, the most theoretical part of the whole book. Instead of giving a full-length account of Marshall's analysis, we shall limit ourselves to summarizing it in four points.[2]

The possible coexistence of market clearing and disequilibrium in Marshallian theory

In Marshall's theory market supply and demand always match. That is, market clearing is always realized. However, to Marshall, market clearing could co-exist with disequilibrium, i.e. a state where agents have an incentive to change their behavior. To make our point, we refer to Marshall's well-known example of the fishing industry (1920, p.307), which is illustrated in Figure 1.

In this passage Marshall studies the reaction of suppliers faced with changes in the demand for fish. We confine our attention to the effect of an increase in demand of moderate duration. Marshall supposes that the new equilibrium price and quantity will quickly be arrived at, without being more precise. In so far as production takes place in advance, and as the change in demand is unanticipated, disequilibrium will be present at least on the market day when the shock manifests itself. If the change in variable capital can be made before the next period of exchange, the new equilibrium will be reached in this next period. But the adjustment process can also be longer because putting variable capital to work can be a time-taking process. In this case, disequilibrium will extend over several such periods.

Starting from a state of equilibrium at t0 (A), a change in demand of moderate duration occurs at t1. As to supply, we have to draw a distinction between market-day supply (MS), which is vertical due to fish's perishability, and short-period normal supply (NS) expressing fishing firms' optimal production plan whenever they have the possibility of changing their variable capital. The initial result of the change

[1] At present this is often (misleadingly) called 'long-period equilibrium'. The reader ought to bear in mind that Marshall reasoned in static terms.

[2] For a more in-depth analysis, see De Vroey (2007).

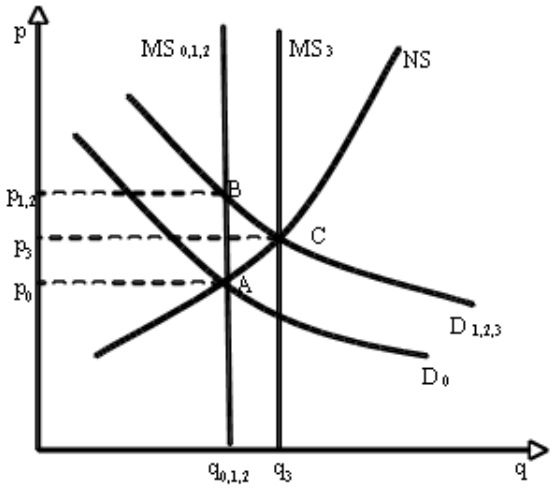

Figure 1: Marshall's supply and demand

in demand is that on t1 the market equilibrium price rises to p1. At B, the market is in disequilibrium, since the short-period normal equilibrium is not attained. In other words, the market equilibrium price and the normal equilibrium price fail to coincide. Note, however, that market clearing prevails. Normal supply and demand do not match but market supply and demand are equal. We assume that it takes two weeks for the new optimal quantity of variable capital to deliver in the new planned production. Hence, the market remains in a state of disequilibrium at t2. The short-period equilibrium is reached on the third week at point C. When the departure from permanent values comes to an end, the market returns to A.

Perfect information as the driving force of the formation of equilibrium

No auctioneer is supposedly present in Marshallian analysis. How are then market equilibrium prices formed? Except for situations in which it is possible to assume that the marginal utility of money is constant, there is only one answer: agents hold perfect information about market conditions. They have the ability to reconstruct mentally the level and shape of the market supply and demand functions and hence to conjecture the equilibrium price. Agents are what could be called price-quantity makers. They propose price-quantity mixes to each other. All sellers will be ready to trade at a price above the equilibrium price, and all purchasers will be prepared to trade at a price below this price, but they can never find trading partners at these prices. As a result, trade will only occur at the equilibrium price. Moreover, once we realize that perfect information is the driving force of market equilibrium, we must forego the idea that its formation is an enduring process. On any market day, equilibrium can be arrived at quickly or slowly, yet this hardly matters. Applying Occam's razor, we can consider the formation of market equilibrium as arising in logical time, i.e. instantaneously.

We are now able to assess whether Marshallian theory has room for the phenomenon of frictions. The answer is 'yes' as far as the formation of normal short-period equilibrium, a process occurring over time, is concerned. The slow adjustment towards normal equilibrium can be considered as due to 'frictions'. However, it is 'no' as far as the formation of market equilibrium is concerned since this is an instantaneous process. The mistake found in the writings of many subsequent Marshallian economists (an example of which will be given below) has been to infer the existence of market non-clearing from that of frictions. This is a false move: there is room for frictions in Marshallian analysis but they can be no cause of market rationing. frictions, if any, co-exist with market clearing.

The labor market is no exception

The above analysis refers to goods' markets. Can Marshall's account of the fish market be extended to the labor market? Our answer is 'yes'. Marshall's scattered remarks in the *Principles* about labor pertained to the particularities of the demand for and supply of labor rather than to the functioning of the labor market. Silence is consent. The bottom line must be that, to Marshall, the labor market operated on the same principles as the corn market, in which case it could not be an exception to the market clearing principle.

The conclusion to be drawn is compelling: there is no room for the notion of unemployment in Marshall's value theory. As for fish, it can be that the market clearing level of employment is a disequilibrium state (either a state of under-employment or over-employment). But underemployment must not be confused with unemployment.[3] However, Marshall was not completely silent on unemployment. Our point is rather that unemployment was no part of his value theory. As Matthews pointed out:

> Cyclical unemployment was par excellence a 'Vol. II' subject, along with business cycles generally. It does get some treatment in the *Principles*, but to a large extent Marshall's views have to be pieced together from his various writings. These are often fragmentary or aphoristic (Matthews (1990), p.35).

The Marshallian trade organization

By the trade organization term, we mean a set of assumptions about agents and their behavior in the market place, as well as about the rules of the game governing the functioning of the market. Between them, a number of traits comprise the Marshallian trade organization. While our account is valid for all type of markets, our concern here is the labor market.

The structure of the market and modalities of meeting

The first characteristic of Marshallian trade organization is that any particular market day is isolated

[3]There is one exception, but it is trivial (and not even considered by Marshall). It follows from assuming an exogenous wage floor. If this is above the market-clearing magnitude, unemployment arises.

from others, opening at a certain hour and closing at another. Agents are simultaneously in contact for the entire time span concerned. They are physically present in the same venue or interconnected in a way that is equivalent to being physically united. Thus, the market is an homogenous setting. Put negatively, it is not to be sub-divided into separate sections where agents located in one compartment are disconnected from those in another. There is direct, full and universal accessibility among traders. No limitations on trade possibilities are present (e.g. there is no rule that a given agent can visit only a certain number of possible trade partners during a market day), nor is there any conceptualization of a queuing process, or of 'first come, first served'.

Information
It is assumed that agents hold perfect information about both the characteristics of the labor being traded and market conditions. As stated above, they are able to reconstruct the market supply and demand functions. The fact that agents need to find trade partners does not impinge on the functioning of the market.

Employment relationship
The notion of an employment relationship can be understood either as the opposite of anonymity or as related to the enduring character of the labor contract. Neither of these plays a role in Marshallian trade organization. No personal engagement is at stake in the labor exchange. The identity of traders does not matter; trade partners are perfectly interchangeable. There is no room in this framework for notions such as a 'job', 'employment relationship', an 'employer', an 'employee', and 'vacancy'. Trade is solely concerned with the number of hours that will be worked over a given time span.

Pricing behavior
As stated above, agents are price-quantity makers. Cooperation or collusion among sellers or buyers is absent. Neither firms nor workers have any way to influence the wage.

Operating forces in the formation of equilibrium
Market supply and demand are the operating forces in the formation of equilibrium values. The individual household's decision bears on a simple confrontation between the marginal utility of the consumption on which wages are spent and the marginal disutility of labor (labor is perfectly divisible). The decisions to participate in the labor force and to work a certain number of hours are not separate. The firms' labor demand equalizes the real wage and the marginal product of labor. Individual supply and demand functions are aggregated to form market supply and demand. Henceforth this will be called the standard supply and demand framework.

Market outcome
Under the above assumptions, there is no way in which equilibrium (market equilibrium, i.e. the balance between supply and demand on a given market day, not normal equilibrium) can fail to be achieved. To repeat, any unemployment is excluded from the model.

Finally, let us consider the Marshallian trade organization in contradistinction to the islands metaphor. It amounts to the absence of scattered islands. Marshall's analysis relates to a unified island characterized

Table 1: Marshallian trade organization

	Marshall
Structure of the market and modalities of meeting	Universal accessibility
Information	
(a) the characteristics of labor traded	Perfect
(b) market conditions	Perfect
Employment relationship	Irrelevant
Pricing behavior	Price-quantity makers
Operating forces in the formation of equilibrium	Conventional supply and demand
Market outcome	Market clearing, no unemployment

by full accessibility across all agents, with no information problem, no search cost, and no matching problems. In other words, the Marshallian market is a highly centralized trade organization.

3 The study of unemployment after Marshall and before the emergence of search models

To Marshall, unemployment did not seem to be a daunting problem. However such a standpoint became more and more difficult to hold during the first decades of the XXth century. In effect, unemployment rose to the top of economists' agenda. But if our previous analysis is correct, this must have created a problem. While most economists interested in the study of unemployment were Marshallian, and wanted to work within the Marshallian framework, this framework precluded unemployment. So, these attempts were doomed to failure. If our interpretation is correct, we should be able to document this difficulty in the literature. This is the task attempted in this section. We shall select a series of landmark studies, and examine how they fare with respect to this difficulty. The authors we consider are first Beveridge, Hicks and Pigou, followed by Keynes and Friedman.

Beveridge (1912): *Unemployment: A Problem of Industry*

In his book *Unemployment: A Problem of Industry* (first edition 1908, third edition 1912), Beveridge addressed the issue of frictional unemployment, criticizing existing theory for having neglected it, although without mentioning Marshall in this respect: [4]

[4]There is only one reference to Marshall in the whole book.

> The weakness alike of theory and practice in regard to unemployment in the past has been the assumption that this adjustment was already substantially secured; in other words that the force of frictions might be neglected (1912, p.216).

Beveridge emphasized three specific imperfections of adjustment, the analysis of which is his book's main objective: changes in the industrial structure, fluctuations in industrial activities, and the need for a reserve of labor. He saw the need for a permanent reserve of labor as mainly being in trades (such as dock work) with large fluctuations in activity, where the reserve constituted a pool of casual labor to meet the fluctuations. "The men forming these reserves are constantly passing into and out of employment" (1912, p.13). Foreshadowing the islands metaphor, Beveridge declared that the common factor underlying these different imperfections was the plurality of labor markets:

> Why should it be the normal condition of the labor market to have more sellers than buyers, two men to every job and at least as often two jobs for every man? The explanation of the paradox is really a very simple one ... that there is no one labor market but only an infinite number of separate labor markets (1912, p.70).

According to Beveridge, the solution to the problem is as straightforward as its diagnosis: the labor market needs to be better organized, that is, to become more centralized. "There shall be known centers or offices or Exchanges, to which employers shall send or go when they want work people, to which workpeople shall go when they want employment" (1912, p.198).

Another idea present in Beveridge's work is that of an irreducible minimum of unemployment, an idea which anticipates that of the natural rate of unemployment (1912, p.68). He also claims that unemployment is a necessary by-product of industrial competition rather than an unmitigated evil. "Unemployment, in other words, is to some extent at least part of the price of industrial competition .... part of the waste without which there could be no competition at all" (1912, p.216).

Beveridge recommends two policies. The first is that agents should become more flexible, in particular "they must have better guidance in the first choice of occupations" (1912, p.236). The second is to set up insurance schemes leading to "average wages over good and bad times [so that the unemployed can] subsist without demoralization till they can be re-absorbed again after industrial transformation" (1912, p.236).

Beyond doubt, Beveridge's book is a first-class contribution, especially in view of its publication date. If offers a wealth of data, and an impressive description of the working of labor markets. It anticipates several insights that will come to the forefront in the search literature, such as the lack of accessibility to jobs and the natural rate of unemployment. We surmise that these ideas, which make Beveridge a precursor of modern theory, have to do with Beveridge being less under the influence of Marshall's theory than the other economists examined below.

Hicks (1932), (1963): *The Theory of Wages*

Published in 1932, *The Theory of Wages* was Hicks's first book, the first of a long series.[5] It is a convoluted book, reasoning in prose, and weighing the pros and cons of theoretical propositions. Its main message is that 'pure theory', i.e. Marshallian theory, should not be applied too hastily for it depends on highly artificial conditions. "Although they may serve as a convenient model for analysis, [these conditions] are not a description of what really happens" (1963, p.56). Hicks's main interest is in what really happens, and in how this involves departures from pure theory. Theory states that wages must decrease in the presence of unemployment: observations show that this does not always happen in reality. Why is that so, asks Hicks. He then puts forward three reasons, each associated with a particular type of unemployment. First, the existence of unions. Second, there is an irreducible level of unemployment due the presence of 'unemployable' workers, whose efficiency is subnormal and who are long-term unemployed. Third, there will always be a certain amount of frictional unemployment. In this, Hicks anticipates search theory:

> For although the industry as a whole is stationary, some firms in it will be closing down or contracting their sphere of operations, others will be arising or expanding to take their place. Some firms then will be dismissing, others taking on, labor; and when they are not situated close together, so that knowledge of opportunities is imperfect, and transference is attended by all the difficulties of finding housing accommodation, and the uprooting and transplanting of social ties, it is not surprising that an interval of time elapses between dismissal and re-engagement, during which the workman is unemployed (1963, p.45).

To him, frictional unemployment is equilibrium unemployment: firms have no interest in profiting from the existence of unemployment to cut wages. Such attempts, he claims, would ultimately prove futile. "By reducing wages he [the employer] has reduced his chances of getting good workmen; and sooner or later he will find that he suffers" (1963, p.46). But he fails to delve further into the matter.

Instead, Hicks emphasizes another possible meaning of frictions, namely frictions understood as the sluggish formation of equilibrium. In his eyes, the hallmark of the labor market is that it takes time for equilibrium to be reached. This then explains the existence of unemployment. "The labor market is not a perfect market; the equalizing forces do not act quickly and easily, but nevertheless they do act" (1963, p.76). As this view was widely taken and is still current, it is worth showing that it does not stand up scrutiny. First of all, it is unclear whether the sluggishness it evokes pertains to reality or to the model, and the judgment to be made about it will differ accordingly. Second, assuming that it pertains to the model, we must ask ourselves whether it fits Marshallian theory. Hicks takes this for granted:

> Wages, say the textbooks, tend to that level where demand and supply are equal. If supply exceeds demand, some men will be unemployed, and in their efforts to regain employment they

[5] A second edition was published in 1963 in which the first edition, reproduced unchanged, was followed by a seventy page commentary in which Hicks explained why he had changed his views drastically.

> will reduce the wage they ask to that level which makes it just worth while for employers to take them on. If demand exceeds supply employers will be unable to obtain all the labor they require, and will therefore offer higher wages in order to attract labor from elsewhere (1932, p.4).[6]

To us, Hicks's view betrays Marshallian value theory as analyzed above. Hicks errs because he fails to separate the formation of market equilibrium from that of normal equilibrium. We have seen that the attainment of normal equilibrium can be a drawn-out process. However, the formation of market equilibrium ought to be conceived of as instantaneous. Hence market disequilibrium only has a virtual existence, being eliminated before becoming effective.

At the time that Hicks was writing, the daily market for dock workers was often taken as an apt illustration of the standard supply and demand framework. It has the additional feature of being effectively managed in a Walrasian way with market prices being set by a market secretary, a useful simplification with respect to the more complicated Marshallian perfect information assumption. Let us then gauge Hicks's statement with respect to it. His statement that, "If supply exceeds demand, some men will be unemployed", is erroneous. If the market secretary observes that supply exceeds demand, he will decrease the announced wage up to the point where the excess supply is eliminated. In other words, disequilibrium has only a virtual existence. It does not become effective. It may be true that the market equilibrium, on the particular day under study, is abnormal in that it deviates from normal equilibrium magnitudes. This will lead to a change in wages and hours worked during the next market days, but all this coexists with market clearing at each period of exchange. Thus Hicks falls prey to the mistake, pointed out earlier in the paper, of believing that slow adjustment can explain unemployment. We may suspect that if an economist as sharp as Hicks could stick to a mistaken understanding of Marshallian theory, this must also have been the case for the majority of other economists at the time. This messy understanding, leading to confusion between disequilibrium and market rationing, may in turn explain the lack of realization that the Marshallian framework and the search insight are incompatible bedfellows.

The author of *Value and Capital* (Hicks (1939)), Hicks is rightly considered an important contributor to economic theory. However, what strikes the reader of his book on wages is how little faith Hicks had in economic theory. Except for the slow adjustment argument, which we find wanting, Hicks viewed unemployment as a topic that could not be dealt with by pure theory. In a sense, he was right: we have shown that unemployment cannot be integrated into the standard Marshallian model. However, he failed to take the next step of understanding that other theoretical formulations (not the Walrasian, which is as powerless as the Marshallian approach in this respect) could be pursued more profitably. In other words, he may well have evoked search as an explanation of unemployment, as noted by Pissarides and Petrongolo (2001), but he failed to see that it could become the cornerstone of a new paradigm about the functioning of markets.

[6]The context makes it clear that Hicks endorses the textbook viewpoint.

Pigou (1933): *The Theory of Unemployment*

Pigou's *The Theory of Unemployment* (1933) is a pure theory book. Like Hicks, Pigou takes it as fact that the excess supply of labor is the normal state of affairs. His analysis is conducted on the premise that labor demand is the active determinant of employment (and hence of unemployment): "The quantity of employment is equal to the quantity of labor demanded" (1933, p.9).[7] That is, firms determine employment unilaterally. For all his having been Marshall's favorite pupil, Pigou failed to realize that this premise was a sharp departure from Marshallian theory. The latter would rather have it as follows: "the quantity of employment is determined by the intersection of the supply of and demand for labor". Pigou is not explicit about the reason behind the permanent excess supply of labor. Most commentators declare that his analysis was confined to a case of fixed real wages.[8]

To the reader's possible frustration, Pigou only tackles the issue of the causes of unemployment in Part V of his book, starting on p.247 of his 320 pages.[9] And what is to be found differs little from what Hicks wrote:

> With perfectly free competition among workpeople and labor perfect mobility, the nature of the relationship [between the real wage and demand] will be very simple. There will always be at work a strong tendency for wage-rates to be so related to demand that everybody is employed. Hence, in stable conditions everybody is employed. The implication is that such unemployment as exists at any time is due wholly to the fact that changes in demand conditions are continually taking place and that frictional resistances prevent the appropriate wage adjustment from being made instantaneously (1933, p.252).

Frictions are thus declared the cause of unemployment. The impression is given that once this cause is uncovered, nothing more remains to be done. No need to theorize frictions seems present. While frictions are the culprit, wage policy is an aggravating factor:

> There is reason to believe that the goal at which wage policy aims is sometimes, in some centers of production at all events, a wage-rate substantially higher than the rate which, if adopted everywhere, would yield nil unemployment (1933, p.253).

Like Hicks, Pigou's reasoning evolves at a high level of abstraction. When he eventually comes to utter a few remarks about the contemporary period, he could hardly be more orthodox: real wages need to be trimmed (1933, p.270). The conclusion to be drawn about Pigou is the same as that about Hicks. Frictions are heralded as the main cause of unemployment, but the link between the two is not theorized.

[7] Pigou qualifies this statement by adding that the number of unfilled vacancies should be subtracted from the quantity of labor demanded.

[8] Further references are to be found in Klausinger (1998).

[9] Before that, we have a painstaking but rather excruciating study of the short-period elasticity of the real demand for labor and of the factors affecting this demand.

Keynes (1936): *The General Theory of Employment, Interest and Money*

Beyond doubt, Keynes's *General Theory* marked a turning point in the study of unemployment. As is well known, Keynes was triggered into writing his book by the emergence of the Great Depression with its massive unemployment. His aim was to explain the occurrence of involuntary unemployment as a kind of unemployment emerging in addition to frictional unemployment. Like his predecessors, Marshallian theory was his base camp. Two premises of his analysis ought to be mentioned. First, Keynes argued that different types of unemployment ought to be distinguished: involuntary unemployment[10], frictional unemployment and a few types of voluntary unemployment, each requiring its own theory. Second, he writes as if frictional unemployment was a matter that had been thoroughly studied and understood. To us, these two premises are questionable. As far as the former is concerned, the fact that a given phenomenon can be caused by different factors does not imply that it ceases to be a single phenomenon (Lucas (1981), p.241). In retrospect, Keynes's coining of the notion of involuntary unemployment can be considered unfortunate (De Vroey (2004)). Everybody agrees that there is an element of involuntariness in unemployment, but this is also true for frictional unemployment, as Beveridge and Pigou claimed! With hindsight, it would have been more appropriate for Keynes to have used a different term, for example demand-deficiency unemployment. As far as the second premise is concerned, we have shown that no serious theory of frictional unemployment existed at the time.

Keynes' great contribution is to have shifted the study of unemployment from a partial equilibrium framework, focusing on the working of the labor market, to a general equilibrium framework where unemployment is viewed as the result of some economy-wide coordination failure. In short, Keynes unwittingly invented Marshallian general equilibrium theory, a quite different approach from its Walrasian counter-part.[11] The fact that Keynes was unable to achieve this program (De Vroey (2004)) should not preclude his receiving credit for this important move. Moreover, when looking at the quality of the reasoning, the conceptual apparatus put to work in *The General Theory*, and comparing it with the existing literature on unemployment at the time, there is no doubt in our eyes that Keynes's work is a great advance on that of his predecessors.

Although Keynes was at pains to point out that involuntary unemployment was only one type of unemployment amongst others, when he came to build a theory of unemployment, he retained only one type, involuntary unemployment. Due to this change in emphasis, frictional unemployment came to be viewed as being of a less theoretical interest, a subject-matter in need of no further investigation. The removal of this view took a long time. It had to wait, first, for the flaws in Keynes's reasoning to be brought to light, and, second, for economic conditions to return to a state where partial equilibrium analysis was no longer considered inadequate.

[10] The term "involuntary" refers to the fact that a worker would be willing to work at a wage prevailing somewhere in the economy, but is unable to do so, for whatever reason.

[11] A Marshallian economy is populated by atomistic agents who possess information about the market conditions, and whose acting upon that information leads to an equilibrium in a single market. Marshallian general equilibrium is thus a result of the interaction between such different markets. In a Walrasian economy, atomistic agents are placed in a single market. They have limited or no knowledge about the market conditions, but equilibrium price and quantity is arrived at under the auspices of auctioneer.

Friedman (1968): *American Economic Association Presidential Address*

Before entering into a discussion of how search models escaped from the Marshallian impasse on unemployment, it is worth pausing a moment to reflect on Friedman's celebrated American Economic Association Presidential Address which introduced the expectations-augmented Phillips curve. The aim of Friedman's paper was to show that monetary expansion could have real effects, but that this cannot be exploited for policy purposes.

One of the reasons this paper became so well known is Friedman's introduction of the notion of a natural rate of unemployment in it (Phelps developed a similar notion at about the same time (see Phelps (1967), Phelps (1968)). The way in which Friedman defines the natural rate of unemployment is quite vague and has no operational value. Nonetheless he refers in it to "the cost of gathering information about job vacancies and labor availabilities" (1968, p. 8). He thereby suggests that search is a central component of the natural rate.

Possibly because of its nature as a Presidential Address, Friedman's 1968 paper is just a narrative lacking an explicit model. This lacuna is corrected in Friedman's *Price Theory* textbook (Friedman (1976)). Here he presents a graph that is meant to describe the effects of monetary expansion on the labor market outcome.[12] Interestingly enough, the study of the graph reveals a feature that is absent from the narrative, namely that, before and after the increase in money supply, the supply of and demand for labor are matching. In other words, if the graph is taken as the representation of Friedman's model (as distinct from his meta-model narrative), it must be concluded that it features no unemployment[13]. Monetary expansion leads to a state where market and supply match at a level different from the natural level, but they match! Friedman's uneasiness is visible in the terminology he uses. To wit, he writes that the market is in a state of "over-full employment" (1976, p. 223). In another passage, he states that, at equilibrium, unemployment is zero but frictional unemployment is positive:

> Unemployment is zero .... which is to say, as measured, equal to 'frictional' or 'transitional' unemployment, or to use the terminology I adopted some years ago from Wicksell, at its 'natural' rate (1976, p.217).

To conclude, Friedman's article can be considered the culmination of the contradiction between the Marshallian supply-and-demand framework and unemployment that we have documented above. Friedman may well have suggested that his natural rate of unemployment notion is underpinned by frictional unemployment, but he was unable to rationalize this insight (Hahn (1995), p.52, and Rogerson (1997)). At the same time, his paper paved the way to the emergence of the search approach. In effect, the aim of giving a foundation to the natural rate of unemployment idea led some economists to devise a new conceptualization of the functioning of the market.

[12] For a detailed analysis, see De Vroey (2007).
[13] This is not the case in Phelps's work.

4 Trade-organization assumptions in search and matching models

In this section we survey four papers which have played a crucial role in the development of search and matching theory. They all aim to rationalize unemployment as an equilibrium phenomenon. While the notion of frictions can be viewed as their common thread, its precise content varies from one model to another: it may pertain to information imperfections, costly search, or time lags. Our claim is that in all cases a breach from the Marshallian trade organization has occurred. Admittedly, search theorists did not express things in this way. Nonetheless this is what their endeavor amounted to.

Two strands need to be separated: search models and matching models. Search models, which saw the light of day first, describe a labor market in which agents look for acceptable wage offers. Matching models, which arose later, consider a labor market in which agents need to find appropriate trade partners. We start by presenting the main features of each model, and then assess it against the criteria used to characterize Marshallian trade organization.

4.1 Search models

The starting point of the search literature may be traced to two articles by Stigler published in 1961 and 1962 (Stigler (1961), Stigler (1962)). The first paper refers to price dispersion in general (an anomaly with respect to Marshallian theory) and the second to wage dispersion in the labor market. Stigler claims that prices and wages in the economy can only be discovered by agents through some costly and time-consuming search for information. Price and wage dispersion result, even in markets for homogeneous goods and labor (pure wage dispersion). Reinforcing processes are at work. A chicken-and-egg problem arises: price dispersion and imperfect information necessitate search and, since search is costly, it itself reinforces the dispersion. As to the factors behind the dispersion, Stigler lists search costs, knowledge obsolescence over time, and the size of the market. An optimal amount of search must exist, depending on the degree of price dispersion, length of potential employment, and firms' size.

In these articles Stigler contents himself with presenting his insights on wage dispersion and unemployment without trying to build a theoretical model for them. A rather long time lapse occurred before Stigler's insights received their first theoretical implementation. We shall examine three of the pioneering articles attempting such a task: McCall (1970), Lucas and Prescott (1974) and Mortensen (1970). These succeeded in giving rise to equilibrium unemployment.[14] McCall's is the most basic model of search at the individual level. Lucas and Prescott's is an islands model based explicitly on Phelps's metaphor, and has recently been revisited in successful studies of, for example, mismatch and rest unemployment (Shimer (2007), Alvarez and Shimer (2008)). Mortensen's model is the precursor of the currently popular wage-posting models which succeed in explaining pure wage dispersion.

[14]Successful rationalization of pure wage dispersion would be achieved much later by Burdett and Mortensen (1998).

McCall (1970): "Economics of Information and Job Search"

McCall's model describes the inter-temporal choice problem faced by an unemployed individual searching for a job in a market characterized by uncertainty, in which different firms offer different wages. The gathering of information about wages is assumed to be costly. While ignoring the overall market conditions, this agent has a precise knowledge of the distribution of wages offered. Nothing is said about the activity of firms, the demand they face, or how they arrive at the specific wages they offer. The worker visits one firm at a time to sample its wage. While searching, he enjoys leisure or home production, less the cost of search (which is taken to be constant). Crucial to McCall's model is the determination of the reservation wage. To calculate it, the agent follows a stopping rule, which consists of comparing the payoff from accepting an offer against the payoff from remaining unemployed and sampling wages again in the next period. After comparing the wage offer with his reservation wage, the worker decides whether to accept or reject the job. If he rejects it, he remains unemployed and continues searching. Otherwise, he starts working and keeps the job forever.

McCall's aim is to get an unemployment result, studied at the level of an individual decision problem rather than as a market outcome in the strict sense. To this end, unwittingly or not, he departs from the Marshallian trade-organization assumptions, abandoning some of its features while introducing new ones. First and foremost, the full accessibility assumption is removed. Now, the structure of the market is defined as implying that an unemployed worker can visit only one firm each period. Second, McCall departs from Marshall's perfect-information assumption by assuming that workers have imperfect information about the market conditions, specifically about the wages offered. As a result of these two changes, agents have to undertake time-consuming sequential search, sampling one wage offer every period. Third, McCall takes a step towards an employment relationship, here in the form of the duration of an employment contract. Consequently, he modifies the Marshallian account of the supply of labor by introducing a search element into the worker's reservation wage. A worker sells zero units of labor if the wage offered is below the reservation wage and one unit if it is above it (labor is indivisible). This new set of assumptions allows McCall to get the desired result: an optimal duration of unemployment spell. Note that the existence of unemployment is the direct result of having breached the full accessibility assumption (the centralized nature of the Marshallian market) and having introduced imperfect information about wages in the economy. Were workers able to visit all markets on the same period of exchange to learn about wages, unemployment would be absent.

Lucas and Prescott (1974): "Equilibrium Search and Unemployment"

Lucas and Prescott's paper addresses the simultaneous determination of employment and wages at the level of the economy. Theirs is a search-island model, following up on Phelps's sketch. The model specifically provides an unemployment result having the properties of a competitive equilibrium along the lines of the natural rate suggested by Friedman (1968) and Phelps (1967).

Lucas and Prescott's economy is composed of a large number of scattered islands. A fixed number of

identical firms producing an identical good are located on each of them. They face a stochastic demand for their product, each period's demand being drawn from an exogenous distribution. Firms produce to satisfy the current demand. Labor is the only input. Workers are identical. The economy's workforce is fixed but distributed over the islands in an endogenous fashion. Thus, in contrast to firms, labor is mobile across islands. Every period, workers optimally decide whether to work on the island where they find themselves, or to leave it and search for employment elsewhere in the next period. They must travel to another island to learn about the market conditions there, including wages. It takes one period of exchange for a worker to be eligible to supply labor on a new island.

Each island features both a competitive product market and a competitive labor market. At the beginning of each period, it has a workforce that includes the incumbent workers and the newly arrived migrants. At this point, demands are drawn and actual employment and wage are determined on each island. Both firms and workers are price takers. Island employment and wages are such that the supply of and demand for labor match. That is, firms employ labor up to the point at which wages equal the marginal product of labor, while workers keep supplying a unit of labor as long as the wage they can obtain makes employment on that island at least as valuable as opting out.

Workers' expectations of market conditions are crucial to the decisions they make. They have no precise knowledge of what wages will prevail in the economy. They only know the joint distribution of demand and the beginning-of-period workforce (that is, the incumbent workforce plus the newly arrived workers) across the islands. The economy-wide value of search is determined at the aggregate level by the intersection of the fixed labor supply and the expected economy-wide demand. Based on their expectations of the market conditions and the economy-wide value of search, workers either remain on their island or leave it for a more alluring one.

Whenever the expected present value of wages from employment on an island is larger than the value of search in the economy, a positive rent arises. In this state of affairs, incumbent workers remain and new workers arrive, attracted by the rent. If the rent is zero, workers are indifferent between working and leaving. Some of them will choose to leave. Lucas and Prescott demonstrate that at least one island with zero rents exists. Some of its workers will leave. Since they are not eligible for employment on another island at once, at any time, a fraction of the workforce will be unemployed.

Market-clearing and unemployment co-exist in this model. As in McCall's model, the central departure from Marshall concerns accessibility. Workers can only visit one island per period of exchange. When they leave an island during a given period they are not eligible for employment on the new island until the next period. Information about the market conditions across the islands is imperfect, but its acquisition is endogenous, and depends on agents' direct learning from operating in the economy. Unlike the standard model, search is now an essential feature of the market. This is a case of directed search: workers optimally direct themselves to specific islands where they expect conditions to be more favorable. There is no employment relationship since the trade involves the exchange of a unit of labor for a specific wage in the current period only. Workers are perfectly interchangeable. While the demand for labor remains standard, the labor supply departs from the canonical model. Although economy-wide labor supply is fixed, labor supply on each island reflects the opportunity cost of working, which is the

value of searching elsewhere in the economy. This value is in turn determined by worker's expectations about market conditions across the islands. Thus the model features equilibrium unemployment: some workers are unemployed, crossing the sea between the islands, but they are nevertheless engaging in optimizing behavior.

Mortensen (1970): "A Theory of Wage and Employment Dynamics"

Mortensen's paper appeared in Phelps's (1970) edited volume. Mortensen's purpose was to give a micro-foundation to unemployment in an environment characterized by imperfect information about the wages on offer. Both the search by workers and the profit-maximizing behavior of firms were modeled. To this end, Mortensen built upon the idea of wage dispersion, which was in the air but remained undeveloped, as the springboard for search behavior. He assumed that the search for work takes time. Workers are homogenous but firms are characterized by different technologies. Workers can only visit a limited number of firms in each period. As a result, the firms no longer encounter the entire labor supply, but just a fraction of it. Against this constraint, they set wages and employment in a monopsonistic manner. Since firms are heterogeneous, their wage offers differ. As it takes time for workers to find some appropriate employment, at any point in time there will be workers engaged in searching and classified as unemployed. This scenario, which now looks obvious, was totally original at the time.

Again, the basic departure from the Marshallian trade organization model is in accessibility, with limited accessibility replacing full accessibility. Firms and workers have an exogenous probability of contact in any given time interval. Hence simultaneous contact between the labor market participants is excluded. Mortensen's model also deviates from the canonical Marshallian model in as far as information is concerned. Information is imperfect with respect to the market conditions. Neither workers nor firms know all the wage offers in the economy. Moreover, workers have different expectations with respect to the mean wage offer. They take this mean as their reservation wage. Since their expectations are different, so are their reservation wages. On the other hand, all firms have the same expectations about the mean. Both firms' and workers' expectations can be wrong. As a result, search, which plays no effective role in the baseline model, becomes a central ingredient of the organization of the labor market.

Unlike Lucas and Prescott, Mortensen introduced a random element into the search process. That is, any contacts that arise are accidental, having nothing to do with agents' expectations. Both the unemployed and the employed search: the former to get a job, the latter to improve their wages. Price behavior is also different. Firms post wages to ensure the optimal net inflow of labor (new hires minus the leavers). They are monopsonists in the dynamic sense, because the flow of labor supply in a frictional labor market is not perfectly elastic with respect to wages. Given the presence of search, to attract and retain labor firms need to incur what Mortensen calls investment. Consequently, firms offer wages which are below the marginal product. Likewise, supply and demand no longer work in the standard way. For any given firm, demand is monopsonist, except that the firm can only access a fraction of the labor supply. Hence it needs to pursue a relative-wage strategy. Labor supply is also cast differently. Labor supply to a firm is determined by the probabilities of workers arriving and leaving: both of these processes are the result of random search, and of the probability of workers accepting the wage offer according to their

expectations-determined reservation wage. The market outcome is equilibrium unemployment.

4.2 Matching models

The matching strand of the search literature springs from the premise that labor markets are characterized by a mismatch, a state where agents fail to instantaneously find an appropriate partner. Pissarides and Petrongolo (2001) described mismatch as

> an empirical concept that measures the degree of heterogeneity in the labor market across a number of dimensions, usually restricted to skills, industrial sector and location (p.399).

This class of models revives Beveridge's categories of vacancies and job searching workers. The most important studies of matching are Diamond (1982a), Diamond (1982b), Mortensen (1982b), Mortensen (1982a), Pissarides (1984a) and Pissarides (1984b). They all introduce a random matching of jobs to workers.[15] However, we shall focus on a subsequent article by Pissarides (1985), which became the canonical matching model featuring a matching function, job creation and wage bargaining.

Pissarides (1985): "Short-run Equilibrium Dynamics of Unemployment, Vacancies and Real Wages"

Like the other papers, this one aims to demonstrate the existence of equilibrium unemployment. Its basic premise is that in any market, especially in the job market, finding the right partner is difficult and certainly not automatic. Pissarides was concerned with a labor market where both firms and workers are constantly searching for each other. He introduced a new dimension, compared to earlier models: the suitability of agents' location and/or characteristics. The problem of location arises because an agent doesn't know where his or her potential traders are located. The problem of characteristics arises because, although outwardly similar, agents have unobserved features which need time to be ascertained.

In Pissarides's model, the labor market contains a fixed labor force and many firms of the one-job-one-worker type. These can be thought of as each producing a unit of homogenous output with a unit of labor, and facing a perfectly competitive goods market where the product price is normalized to unity. Entry to the market is free: that is, the number of firms is endogenous. Workers either work full-time (if employed) or search full-time (if unemployed). Firms find themselves with either a filled job or an open vacancy. Workers and firms reason in terms of total-lifetime expected utility in different states: unemployment, employment, vacancy or job. All agents discount the future using an economy-wide interest rate.

Pissarides's model does not address how agents meet, but limits itself to generating the probability with which vacancies and the unemployed come together. This process of matching is random. It is conceptu-

[15] Models with matching and directed rather than random search, e.g. Moen (1997), appeared later.

alized as a production function, the matching function. Inputs to the matching function are the number of vacancies and searchers; the matches are the output. The matching function, representing frictions, is treated as exogenous.[16] In the simplest version of Pissarides's model, in which match efficiency is always the same and workers always prefer being employed to being unemployed, all meetings result in a match. The arrival rate of workers to firms, and vice versa, depend on the number of searchers on the two sides of the market. Both treat the market conditions as given. In other words, they do not take into account the externality they themselves exert on other searchers on either side of the market (specifically the probability of others meeting their trading partners).

As far as vacancy creation is concerned, whenever firms have vacancies, they expect them to remain unfilled for a while. In this setting, the number of vacancies is determined by profit maximization: profit from the final vacancy created is zero. The ensuing vacancy-creation condition, which corresponds to the marginal condition of demand for labor, is that the profit from the job must compensate for the cost of creating a vacancy. The tighter the market (that is the higher the ratio of the number of firms seeking workers to workers seeking jobs), the higher the recruitment cost and hence the lower the wage that should be paid to preserve the given level of profits. Jobs are destroyed with an exogenous probability.

The formation of wages takes place through bargaining between the individual trading partners. This is a bilateral monopoly setting. Whenever a match is achieved, both sides gain from it. This mutual gain or surplus arises from the presence of frictions and the fact that matching takes time: an existing match which breaks down cannot be immediately replaced by another and a period of search is required for both parties. In the meantime, both the worker and the firm have a lower income. The unemployment benefit and leisure enjoyed by unemployed people give them less utility than the wage, while the firm with an open vacancy incurs a per-period recruitment cost. The surplus is divided between the worker and the firm according to their respective bargaining power. The worker's ability to influence wages depends positively on the market tightness. Workers demand higher wages when relatively more vacancies are waiting to be filled. Conversely, when the market is tight, firms agree to pay higher wages as a means of saving on the cost of keeping the vacancy open. This gives rise to the wage-setting function, which replaces the standard supply function. Since market conditions are perfectly known and agents are outwardly homogenous, in the simplest Pissarides's setting in which workers are always willing to work, a single wage is bargained instantly in the economy.

As above, there are differences between this model and the traditional Marshallian one. Again, full accessibility is absent. Agents meet with at most one partner each period. Pissarides's labor market is such that firms and workers take time either to locate or identify a trading partner. The information set-up is also different. Unlike previous models, information imperfections concern location and/or unobserved heterogeneity in labor characteristics and productivity. On the other hand, perfect information prevails with respect to market conditions. Search becomes a central feature of trade organization. Here, it concerns a suitable partner, instead of a wage as in the other models. This marks the entry of the matching theme into the theoretical realm. A new category, absent from both the Marshallian model and the other search models, now becomes important, namely the employment relationship. Agents are no longer

[16]Only later did studies attempting to give micro-foundations to frictions appear in the literature. In such studies frictions are modeled explicitly and endogenously gives life to a matching function. It arises as a result of agents' interactions or the mismatch in skill, industry or location.

perfectly interchangeable. Moreover, matches are long-lasting. Another difference is that in Pissarides's model, demand and supply are replaced as forces in the formation of equilibrium by the new notions of vacancy-creation and wage-setting functions. The market outcomes are the single equilibrium wage and equilibrium market tightness. At any time, unfilled vacancies and frictional unemployment coexist. In Pissarides's simplest model, unlike that of Lucas and Prescott, some notion of frustration crops up. While firms are in an optimizing position, some unlucky searchers are frustrated by being unable to find a partner.

5 Contrasting the Marshallian and the search models

The models considered all depart from the Marshallian model of trade organization. But they also differ between themselves. To show this, let us recast them in terms of Phelps's islands parable.

We start with Lucas and Prescott's model since it is explicitly based on this parable. Here unemployment exits because some agents leave the zero-rent island to find better conditions elsewhere. It is furthermore assumed that there is a time lag before becoming eligible to participate in another labor market. This explains the coexistence of market clearing in the different markets and unemployment in the economy: the unemployed are between islands, between individual labor markets.

Recasting McCall's model in the islands framework is easy. The labor market is divided into scattered islands. A wage is posted on every island, the origin of its magnitude being unexplained. Wages vary from one island to another. Upon arriving on an island, the worker compares the wage offered there with his or her reservation wage, and decides either to settle down or to travel to the next island.

In the Mortensen story each island is inhabited by a single firm. Workers cruise between the islands, visiting them randomly, a limited number of islands per day. Firms post wages and upon their arrival workers decide to take the job or to try elsewhere. Moreover, once settled on an island, workers randomly decide whether to stay or to leave and look for better prospects somewhere else.

In Pissarides's model there are two possible stories: one about the location, the other about the unobserved heterogeneity, both of which end up being modeled in the same way. To keep to the maritime metaphor, we replace the islands with boats circulating across a sea. They are of two types. The first is the F-boat, F standing for firms. It carries a machine that needs one person to operate it. The number of these boats can vary. The second type is the W-boat, W standing for workers. This boat carries one person, who has the ability to work the machine, but does not have one on his or her boat. The number of W-boats is fixed. Both types of boats cruise across the sea searching for a match. As soon as an empty F-boat encounters an available W-boat, the match is made. The worker attaches his boat to the F-boat and starts working on the machine. It takes time for boats to encounter each other. We must imagine that the weather is misty and radio connections are absent. This prevents the partners locating each other immediately or recognizing the exact characteristics of other boats. On the other hand, strong wind can from time to time detach F- and W-boats: this is the separation aspect of the Pissarides

scenario. Separations and search between them explain why there will never be a state where vacancies and unemployment are zero.

As mentioned at the beginning, the Marshallian story is simple. Instead of having many islands or boats, there is just a single one. Generalized accessibility prevails. So there is no reason for wage dispersion (and the consequent incentive to search) or time-consuming matching.

The same matter can be approached differently by looking at the decisive factors responsible for the occurrence of unemployment. In Lucas and Prescott's model, it is institutional in nature. Unemployment hinges on the waiting rule: workers cannot start working immediately on another island. Otherwise there would be no unemployment. In Mortensen's approach, the limited feasibility of visiting the islands on a given day and learning about the market conditions there is crucial. Were workers' boats faster, allowing them to visit all the islands on the day of exchange, there would be no unemployment. In McCall's writings, the obstacle to full employment is again the feasibility of contact; it is even stronger here than in Mortensen's approach, since a worker can only visit one island in a day. In Pissarides, the mist can be seen as a metaphor for the randomness or, in other words, the limited feasibility of matching between partners. If there were no mist, partners would find each other at once.

Table 2 summarizes the contrast between the Marshallian trade organization on the one hand, and the search and matching trade organization on the other. We start by commenting on the Marshallian trade technology column. The Marshallian market is characterized by the universal accessibility of trading partners, perfect information with respect to the characteristics of labor and market conditions, and the absence of any enduring employment relationship between employers and employees. As a result, no search is required, and no matching problem is present. Market clearing is a compelling result.

Turning to search models, we look at them line by line:

The structure of the market and the modalities of meeting
In none of the search models does the structure of the market feature universal accessibility. The economy is segmented, and agents are disconnected from each other. While different meeting modalities can be envisaged, the common ground is that agents are no longer simultaneously in contact. Limitations on trading possibilities ensue.

Information
In the search models we considered, information is imperfect with respect to at least one of three objects: labor characteristics, market conditions, or the location of partners.[17]

Search and matching
Given the non-homogenous setting and information imperfections, search and matching have to take place.

[17]This is no longer the case in very recent search literature. Contemporary models preserve market segmentation but often forgo information imperfections.

Employment relationship
In all the models but one, some form of employment relationship is present, either by assumption or as the result of market structure, information and search behavior. The exception is Lucas and Prescott's model in which there is no employment relationship. In McCall's conception contracts stipulate the duration of employment, a first step towards the notion of an employment relationship. Mortensen suggests that investment in attracting and retaining labor is needed. For Pissarides, the notion of an employment relationship is important because worker-to-job matches can be personal and not anonymous.

Pricing behavior
With the exception of McCall's model, where wages are exogenous, pricing strategy is a direct consequence of the first four benchmarks. With no employment relationship, price-taking behavior is possible, as in Lucas and Prescott's paper. However, when the nature of the employment relationship induces investments or rents, then a non-competitive price-setting is needed. This is the case of Mortensen's and Pissarides's papers.

Operating forces in the formation of equilibrium
McCall only treats supply, which is clearly search-founded. Lucas and Prescott consider demand in the traditional way, but supply is search-and-expectations augmented. For Mortensen supply also embodies a search-and-expectations component. Demand is also affected by market fragmentation, as firms post relative wages. Pissarides's model replaces demand and supply by vacancy creation and wage setting. Thus we observe a gradual move away from the traditional framework of supply and demand.

Market outcome
In all models unemployment arises as an equilibrium outcome.

6 Concluding remarks

In this paper we have attempted to identify obstacles to the take-off of the search approach to unemployment. Adherence to the Marshallian value theory, which has no room for rationing (and hence for unemployment), was the predominant hurdle. The trade organization, or conceptualization of the functioning of the market, in the Marshallian framework excludes the presence of unemployment. Earlier authors, studied in the first few sections of the paper, attempted to develop the frictional unemployment insight, but were unaware that to do this they needed to depart from the then-prevailing Marshallian trade organization assumptions. This is exactly the move that search writers made. Following Phelps, they introduced market fragmentation. On the basis of this departure, they started to explore alternative possibilities about informational assumptions, forms of search and matching, employment relationships and pricing behavior. Unemployment could then enter economic theory.

Table 2: Trade organization

	Marshall	**Search and matching**			
		McCall	**Lucas-Prescott**	**Mortensen**	**Pissarides**
The structure of the market and modalities of meeting	Universal accessibility	Limited accessibility (visiting one island each period)	Limited accessibility (visiting one island each period)	Limited accessibility (visiting at most a fraction of firms each period)	Limited accessibility (matching with at most one firm each period)
Information					
(a) the characteristics of labor traded	Perfect	Perfect	Perfect	Perfect	Imperfect
(b) market conditions.	Perfect	Imperfect	Imperfect	Imperfect	Perfect
(c) the location of potential partners	Irrelevant	Perfect	Perfect	Perfect	Imperfect
Pricing behaviour	Price-quantity makers	Exogenous offered wage distribution	Price takers	Wage posting, dynamic monopsony	Bargaining, bilateral monopoly
Search and matching	Irrelevant	Sequential search	Directed search	Random search	Random matching
Employment relationship	Irrelevant	Contract of infinite or or finite duration	Irrelevant	Investment in retaining labor	Bilaterally favorable match
Operating forces in the formation of equilibrium	Conventional supply and demand	Exogenous demand; individual search-augmented supply	Demand as conventional marginal productivity; search-and-expectations-augmented supply	Variant of monopsonist demand; search-and-expectations-augmented supply	Vacancy creation; wage setting
Market outcome	Market clearing, no unemployment	Unemployment	Market clearing, unemployment	Unemployment	Vacancies and unemployment

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ISSN 1379-244X D/2009/3082/005